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A SIMPLE RECORDING SYSTEM FOR SMALL CURRENTS

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by
G. W. Monk

Carbide and Carbon Chemicals Corporation (Y-12)

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A SIMPLE RECORDING SYSTEM FOR SMALL CURRENTS

By G. W. Monk

ABSTRACT

A recording system is described which is especially suited for recording small currents of the order of 10^{-13} amperes.

* * * * *

Most commercially available recorders do not lend themselves readily to the recording of small ion currents of the order of 10^{-13} amperes because of their low input impedance. Several circuits have been given in the literature which combine high impedance DC amplifiers or vibrating reed electrometers with such low impedance recorders but the circuit described here is much simpler and perfectly reliable for recording small currents where a slight zero drift in a few hours is not important. It is especially suitable for recording receiver current in mass spectrometers and has been used successfully with a 9 cm trochoidal mass spectrometer and with a Nier type mass spectrometer.

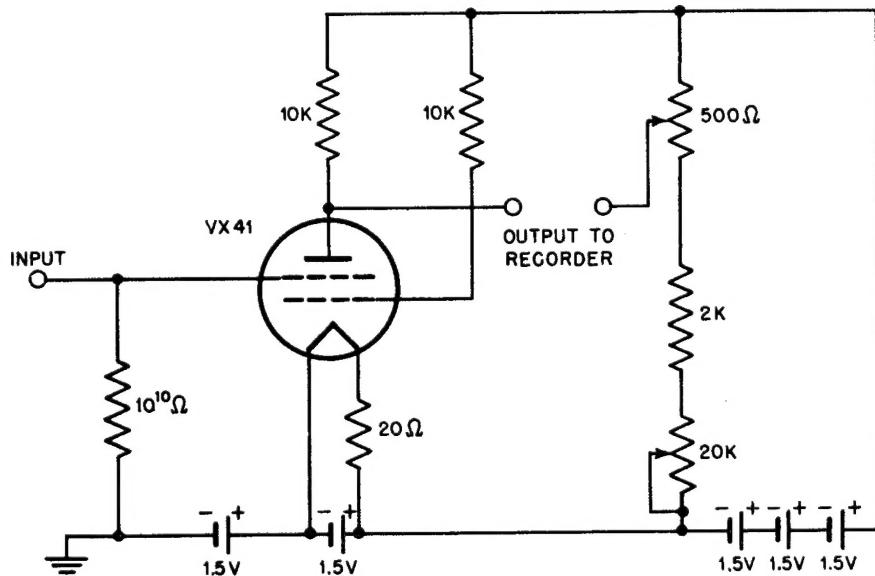


Figure 1. Circuit of the recorder for use with the Brown "Electronik" Recorder.

A Brown "Electronik" strip recording potentiometer, giving full scale reading for 10 mv input, will work successfully from an impedance of 10,000 ohms if the damping condenser and resistor are removed. The circuit shown in Figure 1 has been used with recorders having both 2.5 and 5 inches per second pen travel rates. The voltage gain of the circuit is about 0.25 so that the recorder deflects full scale (10 mv) when a current of 4×10^{-12} amperes flows through the 10^{10} ohm input resistor. The zero drift is entirely negligible for a period of an hour or more if the temperature remains fairly constant. Measurements have shown the output to be proportional to the input throughout the scale and should be linear over a much wider range. The VX41 electrometer tube should of course be shielded and placed as close as possible to the current source to decrease the input capacitance. The speed of response in most applications has been limited by the writing speed of the recorder.